

Title: What learning happens? Using audio diaries to capture learning in response to safety-related events within retail and logistics organizations.

Colin Pilbeam, Ross Davidson, Noeleen Doherty and David Denyer

Cranfield University School of Management, Cranfield, MK43 0AL, UK

Corresponding author:

Email: [colin.pilbeam@cranfield.ac.uk](mailto:colin.pilbeam@cranfield.ac.uk)

Tel: +44 1234 751122

## ABSTRACT

Learning from safety incidents has typically been investigated amongst front-line workers in high hazard contexts. In contrast this study collected safety incident data using audio-recorders from 21 respondents across the organizational hierarchy in two retail and one logistics company in the UK. The diary data highlight the propensity for problem-fixing in a single-loop learning mode rather than deeper, double-loop learning problem-resolution. The latter occurs amongst those with organizational responsibility for safety, irrespective of hierarchical position. The observation of violations is suggestive of prior learning of correct procedures and these data suggest that near-misses are under-reported in organizations.

## KEYWORDS

Organizational learning, audio diary, safety practices, logistics, retail, violation, error.

## 1. INTRODUCTION

Safety in organizations is, for many, critically dependent upon reducing errors and eliminating mistakes. Yet the occurrence of both errors and mistakes provides opportunities for individuals, and organizations, to learn and to change, facilitating improved safety practice. Learning from errors and mistakes however is not guaranteed. In organizations it is not uncommon for the same mistakes and errors to be repeated and for safety incidents to recur (Buchanan and Denyer, 2015), even serious ones. For example, accidents on the UK railways are attributed regularly to drivers passing signals at danger. This caused an accident on the Great Western main line at Southall, London in September 1997 and another a few miles away on the same line at Ladbroke Grove, London in October 1999. Less critical incidents recur more frequently in many organizations. Despite the organizational desire to reduce errors and to eliminate mistakes and so minimize accidents and incidents, they are still repeated. An important question therefore is what prevents organizations from learning from their mistakes and errors to improve their safety performance?

According to Argyris and Schön (1974) learning involves the detection and correction of error. They suggest two forms of learning. Single-loop learning simply fixes the presenting problem, while double-loop learning challenges the existing situation to discover a different way of acting or behaving. Fixing a presenting problem without addressing the underlying causes allows an organization to continue with its existing policies and practices but results in the possibility of the problem recurring. Conversely modifying organizational policies and practices through double-loop learning may eliminate the possible recurrence of a particular mistake or error. Of course this can be more costly in terms of time and resources. Organizations that emphasize single-loop learning more than double-loop learning may therefore be less likely to learn from their mistakes and errors. In an observational study of junior nurses in eight hospitals in USA (Tucker and Edmondson, 2003) argued that single-loop learning (or simply fixing a presenting problem) was overwhelmingly the more common response of these junior staff. They also suggested that the relatively dynamic, strongly hierarchical organizational context actively discouraged double-loop learning. Their conclusion was that incidents in such high risk environments were therefore inevitable, as staff became burnt-out with the additional burden of managing the day-to-day irritations of a partially effective organizational system.

Our study investigates the occurrence of single and double-loop learning amongst different hierarchical categories of employees in response to safety incidents caused by a 'gap' between an expected and an actual state or practice in organizations in more stable, less dynamic, low risk environments using a novel audio-diary approach. It contributes empirically to our understanding of

safety learning in organizations in four ways. First, we confirm the findings reported for other contexts, that employees in service-type environments predominantly adopt single-loop learning rather than double-loop learning following safety related incidents. Following the well-rehearsed argument (Tucker and Edmondson, 2003; Lukic et al., 2012) this may suggest that learning from safety related incidents in these settings is uncommon. Second, the data suggest that organizational role rather than hierarchical position in the organization, affects whether employees engage in double-loop learning. Those with formal safety responsibility regardless of position are more likely to engage in double-loop learning than those without such responsibility. Third a comparison of our data with records of accidents and particularly near-misses in the case organizations suggest that organizational estimates of near-misses are low and that there is substantial under-reporting. This has implications for improving levels of organizational safety, if such near-miss data are used as significant indicators of future incidents. Fourth, while diaries have been used in other fields to capture lived experiences they have not been used in the field of safety research. Here we modify this approach to make use of audio-recorders, which are a cost effective and accessible method for collecting real-time data relating to safety incidents across a larger population than would be possible by the ethnographic methods previously used in safety research.

## 2. LITERATURE REVIEW

### *2.1 Learning in organizations*

Edmondson and Moingeon (1998) and Shipton (2006) develop very similar frameworks along two separate dimensions to categorise perspectives on learning in organizations. The first dimension distinguishes between studies that have the individual as the unit of analysis and those that focus at the organizational level. The second dimension considers whether the research is prescriptive and interventionist, or descriptive. Organizational learning research is then populated against the resultant 2x2 matrix. Both reviews consider the existence of organizational routines and practices as evidence of prior learning at an organizational level, which is then typically communicated to new employees through induction and other ongoing training, and codified in standard operating procedures. The problematic nature of the connection between learning at an individual level and learning at the organizational level is highlighted. One framework which encapsulates the interplay between learning at the individual and the organizational level, is that proposed by Crossan et al. (1999). The 4I framework suggests that through the processes of intuiting and interpreting, individuals feed-forward their learning to influence the organization. The processes of integrating

and institutionalizing formalize and embed this individual learning in organizational rules and practices and the feed-back from the organizational level constrains and directs individual behaviour and actions.

Feed-forward and feed-back loops are vital characteristics of learning which Argyris and Schön (1974; 1978) incorporate into their models of single and double-loop learning. Single-loop learning occurs when individuals after detecting an error seek to find a solution consistent with their framing of the circumstances and one that permits the organization to continue with its policies and practices unaltered. Alternatively, a double loop model of learning is apparent when an individual in developing a solution scrutinizes the circumstances and the proposed action plan. These may lead to a modification of the organization's policies and practices. Single-loop learning takes the circumstances as given and operates broadly within existing routines to increase organizational effectiveness. This is essentially a closed and defensive response to the error (Argyris, 1976) that seeks unilateral control of the environment and the task to protect self and others, so that no-one is embarrassed by challenge. Causal reasoning reduces sensitivity to feedback permitting only confirmation of existing expectations and so the freedom of choice of potential solutions is restricted. Double-loop learning is quite different. Here individuals are encouraged to test publicly assumptions and beliefs and to participate in the design and implementation of actions and to create a wide variety of solutions that subsequently may feedback to affect individual behaviours in the future. In this mode, substantial or radical organizational change is more likely than incremental change.

Reason et al. (1998, pg. 292) define errors as "the failure of planned action to achieve their desired ends", and according to Argyris (1976) their detection and correction is key to organizational learning. Alternatively, Tucker et al. (2002, pg. 124) suggest that learning can occur through problem solving, the closing of "an undesirable gap between an expected and observed state that hinders a worker's ability to complete a task". The difference between these two concepts of learning hinges on the definitional distinction between 'errors' and 'problems' (Tucker and Edmondson, 2003). However, in practice both errors and problems require the resolution of a discrepancy between expected and actual practice. This 'gap' (Figure 1) once it has been observed (which is the starting point for the cycle in the figure) it can be investigated and then often it can be resolved in similar ways, irrespective of whether it came from an error or a problem. Correcting errors through single or double-loop learning is considered to be analogous to first and second-order problem solving (Tucker et al, 2002). First-order problem solving, like single-loop learning, fixes the presenting problem but does nothing to prevent it reoccurring, whereas second-order problem solving like

double-loop learning seeks to diagnose and alter the underlying causes of the problem to prevent recurrence.

INSERT FIGURE 1 NEAR HERE

In addition to problems and errors, a third category of discrepancy between expected and actual practice exists, namely rule violations. Desai (2010; pg 185) defines these “as the voluntary and intentional departure of behaviours from rules governing how that behaviour should occur in organizations” and notes that they are only infrequently incorporated into discussions of organizational learning. Problems, errors and violations each provide opportunities or stimuli for learning. However, we suggest that the type of learning that occurs depends upon the individual’s response to the circumstance (Figure 1). An individual is able to observe a rule violation by another colleague when they are aware of the organizational rules and operating procedures, most probably learnt through prior training. Organizational level influences which transmit what behaviours are acceptable affect individual behaviours through feedback mechanisms (Crossan et al., 1999). These reinforce prior individual learning. Taking corrective action to fix a problem, but not addressing any of the underlying causes indicates single-loop learning (or first-order problem solving). Escalating or communicating a problem to more senior colleagues or external agencies to make wider systems changes to resolve a problem and remove the underlying causes to prevent recurrence indicates double-loop learning or second-order problem solving (Tucker and Edmondson, 2003). In Crossan et al.’s (1999) framework this corresponds to feed-forward where the individual influences the organization, suggesting possible changes to practices and providing an opportunity for organization-level learning.

Problems, errors and violations therefore provide opportunities for observing and investigating organizational learning. However, the type of learning that occurs depends upon whether individuals simply fix the problem following the model of single-loop learning, or whether they make wider system changes to remove the underlying causes following a model of double-loop learning. In these contexts challenges to existing operating processes are likely to be unwelcome, and double-loop learning discouraged (Fiol and Lyles, 1985). The focus is more likely to be on problem solving to ensure technical improvements and the maintenance of the processes. These environments are also likely to limit discretionary activity which facilitates experimentation and investigation, thereby reducing opportunities for double-loop learning and emphasizing single-loop learning. Such conformity tends to inhibit organizational learning (Edmondson, 2004). However such benign stable organizational environments are increasingly uncommon, with current organizational environments

being characterised as volatile, uncertain, complex and ambiguous (VUCA; Bennett and Lemoine, 2014), that require double-loop learning to resolve new organizational challenges.

## *2.2 Organization learning for safety*

In their review of learning in the safety literature Drupsteen and Guldenmund (2014) concluded that how learning occurs had been rarely studied, noting that safety research would benefit from input from organizational learning theories, such as Argyris and Schön's (1978) models of single and double-loop learning. Prior to this review, Lukic et al. (2010) had developed a framework for learning from incidents in the workplace that had four dimensions (learning process, learning participants, type of knowledge, type of incident). The learning process incorporated the single and double-loop learning concept of Argyris and Schön (1978) to question what kind of learning process was adopted in response to the incident. Following empirical validation of the framework in the energy sector a fifth dimension (learning context) was added (Lukic et al., 2012) but the choice of learning process (single or double-loop learning) remained. Moreover, Lukic et al. (2012) noted the emphasis on single-loop rather than double-loop learning in response to safety incidents, because there was no incentive to share near misses and other small-scale incidents with others for fear of embarrassment. Yet they acknowledged the importance of the need for awareness of small-scale events in potentially mitigating further more serious safety incidents. This supports Drupsteen and Guldenmund's (2014) more general conclusion that existing safety learning studies report reluctance for individuals to share information with others, and that learning in safety research implicitly adopts a single-loop learning approach focusing mainly on ways to improve existing processes.

Accidents and near misses in organizations are often the result of problems, errors or violations and they recur because of the failure of organizations to learn (Drupsteen and Guldenmund, 2014). While rare and unusual events which can impact whole organizations may trigger organizational learning (Lampel et al., 2009; Beck and Plowman, 2009) commonplace incidents perhaps impacting single individuals or small groups also trigger organizational learning through either single or double-loop learning, and occur more frequently. These latter incidents arising from a discrepancy between expected and actual practices have been attributed to the acontextual nature of much formal safety training. Somerville and Lloyd (2006) reported that actual working practices deviated from codified safe working practices in a range of different sectors including aged care, coal mining, building construction and fire and rescue services because the standardized safety training failed to take account of the need to alter practice in response to the variation in social and physical environments in which the workers operated. As a consequence everyday work experiences are often valued more highly by individuals as safety-specific learning opportunities than formal safety training courses and

seminars as shown by Maslen (2014) for young engineers in the Australian gas pipe-line industry and by Størseth and Tinmannsvik (2012) in the rail and marine sectors too.

While the experience of errors and problems during the working day may trigger individual safety learning through single-loop learning, the observation of rule violations indicates prior learning through the awareness of standardized practices and expected behaviours, and may also act as a stimulus for learning as individuals seek to understand or correct the discrepancy between expected and actual practice. Sanne (2008) in an ethnographic study of railway maintenance technicians in Sweden reported in detail how their practices deviated from written practice and why this deviance went unreported. An earlier study by Lawton (1998) reported deliberate deviations from written rules by railway shunters in the UK and identified three classes of violations: exceptional (unusual circumstances requiring an unusual response); situational (based on a desire to keep the job going in adverse circumstances); and routine (a short cut regularly taken). These three were differentiated from unintentional violations arising from ignorance or inexperience, which correspond to error. Mascini (2005) reported similar rule violations by workers in a coke factory in The Netherlands. In all of these cases the deviation of actual practice from expected practice had been normalized and accepted (Vaughan, 1999). Deviant practice became acceptable and rarely triggered challenge and therefore no opportunity for individual learning. In these cases individuals had simply learnt a different practice, or routine, from that anticipated by the organization.

In their review of safety management in organizations, Zanko and Dawson (2012, pg. 32) asserted that, “we need to examine individuals in work settings, [examining] the workplace environment and daily operating procedures as well as the tasks and activities that occur within context and over time”. Such studies of individuals in their daily workplace would indicate where single or double-loop learning occurs in response to the errors or problems that create safety incidents, including near-misses, and where safety rule violations can be observed and responded to. Many of the studies in the safety literature including those reported above focus on riskier or more hazardous environments. Safety learning by individuals working in organizations in lower risk, less hazardous contexts remains under researched. Moreover, it is unclear whether safety rule violations occurring in risky high hazard environments are replicated in low hazard environments. In addition, Smallman (2001) called for more safety research across hierarchical levels to indicate differences and similarities between different groups. Safety research has typically focussed on front-line employees and their supervisors (Zohar and Luria, 2003; Kapp, 2012), and ignored managers further up the organizational hierarchy, who might have different experiences of safety, but also make a different contribution to safe working in organizations.



### *2.3 Collecting data on safety practices*

Accessing and collecting data about day-to-day activities and events relating to safety presents a challenge (Zanko and Dawson, 2012) . An ethnographic approach allows in-depth observation, for example Iszatt-White's, (2007) investigation of violations of safety practices amongst UK construction workers. An alternative, more cost-effective technique is the diary method, where individuals record their actions in real time (e.g. Daniels et al., 2013; Katzeff et al., 2012). Diaries allow the collection of qualitative data which can provide rich descriptions of events to facilitate and understanding of day-to-day practices and inter-relationships (e.g. Symon, 2006) or to highlight the salience of a sensitive issue such as ethnic identity (e.g. Atewologun, 2011). Thus, the diary method is particularly suited to collect data on responses to problems and errors affecting safety in the workplace and the recording of any violations of safety rules observed.

Using diaries as a mechanism for encouraging employees to record safety events and the outcomes at the time of their occurrence allows us not only to discover those triggers to learning but also to capture either explicitly or implicitly the courses of action taken in response to those triggers and therefore whether learning was single or double-loop. The diary approach can reveal not only how individuals respond to problems and errors, indicating the type of learning they display but also the occurrence of safety rule violations and therefore deviation from taught practises and learned routines. Recording a number of events by individuals spanning an organizational hierarchy over time allows a rich picture to be developed that indicates what is being learnt by whom and how.

Responding to the challenges of both Smallman (2001) and Zanko and Dawson (2012) and using Argyris and Schön's model of single and double-loop learning as an organizing framework , we investigate the occurrence of different types of learning in the execution of safe working practices by respondents from across the organizational hierarchy in retail and logistics organizations. In order to capture these learning incidents we adopted an audio-diary method, whereby respondents were asked to use an audio recorder to capture the incident and their responses as the event occurred, where possible within the constraints of normal, safe, working practice.

## **3. METHODS**

This study formed part of a larger investigation of safety leadership and safety practices in service sector organizations. An overwhelming majority of the workforce in both the UK (Office for National Statistics, 2013) and across Western Europe and the US are employed in service industries. These organizations characteristically have a highly centralized bureaucratic structure, with a dominant

head-quarters developing policies and practices to be enacted locally without deviation. There has been only limited investigation of safety leadership and safety practices in these contexts, for exceptions see Barling et al. (2002), Bentley and Haslam (2001), Dejoy et al. (2004) and Kelloway et al. (2006). The study from which data are drawn for this paper, sought to understand when during the working day safety became salient to different categories of employees, and to determine the nature of these triggers and what the response to them was. Taking a learning perspective, this paper describes and synthesises the nature of learning (single/double-loop) in response to safety incidents (problems, errors or violations) reported by a cross section of employees (front-line workers, supervisors and managers) in major retail and logistics companies operating in the UK.

### *3.1 Data Collection*

Using an event contingent data collection strategy, audio diary records were kept by 21 respondents. They recorded when, during their working day, safety became salient to them. Respondents came from three organizations across six different sites. Two units each from two different UK retail chains, one with more than 700 stores selling general merchandise and the other DIY materials and home furnishings from more than 300 stores, were complemented by two warehouses from a global logistics company with more than 100 locations in the UK. Participants occupied one of three possible roles: manager, supervisor or front-line worker. Table 1 shows the distribution of participants in different job roles across the three organizations.

INSERT TABLE 1 NEAR HERE

The participants, who were identified by their local manager, were asked to keep a diary for a period of 14 days, recognising that they may not be working every day. These individuals were given a digital voice recorder and then briefed by a research team member. Included in the briefing was an explanation of how to use the voice recorder and a short description of the data collection protocol. Diarists were asked to note when during their workday they became mindful of safety. For each of the identified incidents they were asked to respond to five open-ended questions. They were asked to identify when and where the incident occurred, why safety came to mind, whether anything happened, who was involved and what the immediate outcome was. Finally, they were encouraged to make their recording as close to the time of the incident as possible to minimize any hindsight bias (Podsakoff et al., 2003; Ohly et al., 2010). They were encouraged also to record at the end of the day if nothing happened during the day to make safety salient to them. To increase participation, and following the suggestion of Atewologun (2011) and Poppleton et al. (2008), personalized text

message reminders were sent by research team members to participants every few days encouraging them to complete their diary. Upon completion of the two week period of data collection, the recorders were collected by a research team member. Participants were debriefed to better understand their experience of keeping the diaries. Notes of these conversations were captured.

### *3.2 Data analysis and coding*

The audio recordings for each incident from every participant were transcribed. The rich narrative from the transcripts were analyzed using template analysis (King 1998). This is a widely used technique suited to managing and reducing narrative data to a set of themes derived from the literature (Patton, 2005). The literature identifies a range of possible triggers or events which can increase the salience of a safety issue. For example, these include an identified '*hazard*'; an actual '*accident or injury*'; witnessing a '*violation of a safe working practice*', '*H&S meetings*' or '*training*'. Our data were classified and sorted according to the type of trigger or event which raised safety awareness. From our data, triggers included, for example: '*spilt paint*', an individual '*banged their head*', staff walking into the warehouse '*without hi viz*'. The data were also coded according to the nature of the outcome of the event, for example '*removing a potential hazard*', '*recording an accident*' and '*reviewing policy*'. To ensure our coding of the data was robust, three researchers together coded the narrative for each incident against the template. Differences in interpretation were reconciled through discussion.

For many, but not all, of the incidents it was also possible to identify the learning opportunity they presented to the respondent. Following Tucker and Edmondson (2003) we differentiated between single and double-loop learning. Single-loop learning (or first-order problem solving) responses were indicated by respondents recording that they found solutions immediately to presenting problems, often without the help of others, although like Tucker and Edmondson (2003) we also included in this category incidents where help was obtained from close peers. Incidents where respondents referred problems to more senior colleagues or external agencies were coded as double-loop learning (or second order problem solving), as Tucker and Edmondson (2003) did in their study of problem solving in hospitals. Violations were indicated by deviation from either standard operating procedures which we had been told about in earlier interviews with the respondents or from known legal safety requirements.

## 4 FINDINGS

The 21 respondents made a total of 162 separate reports covering at least 84 person-days of data collection; not everyone identified the day on which they reported. Twenty two reports stated that “there haven’t been any incidents today”, or simply “no issues”. Of the remaining 140 reports over half (n=77) were suggestive of some form of learning. Forty-eight reports referred to situations that were resolved immediately by the respondent with or without the help of a peer, indicating single-loop learning. Thirteen reported situations were referrals to other people more senior than the respondent, suggesting double-loop learning. There were 16 recordings which related to the observation of violations of standard operating procedures. The remaining 63 reports covered a range of topics such as ‘attending training’ or ‘H&S meetings’, ‘reading briefings’, ‘checking equipment’ and reflections on safety, such as *“we talk about Health and Safety and we talk a good game but ultimately it always comes down to meeting the customers’ requirements”*, and *“I think sometimes [Health and Safety] can go slightly overboard, sometimes it can be a bit drastic, but if used correctly it can be brilliant”*.

### 4.1 Single-loop Learning

Table 2 shows the number of reports made by different groups of workers in the case organizations that indicate single-loop learning. This was most frequently presented by front-line workers in retail. In several cases this was because they were dealing with equipment that had been incorrectly placed or secured. In other instances stock in the stock rooms had been incorrectly positioned creating a hazard, requiring them to reposition it. For example, *“overhanging objects in the aisle, so they’re below the ladder height, so as you push them along they’ll fall on top of you. So I just relocated them to a better space”*. Another front-line worker in a different store described the following hazardous situation. *“There is a suitcase in a box and a microwave perched on top, the microwave has got a warning sticker for 21 kg. There is a heavy item on top of a small item. There also appears to be an item of furniture in a box which is essentially propping up this microwave. If this item was moved it would definitely fall. What I’m going to do is attempt to rearrange some of the stock to a more safe and logical order so that it doesn’t present a hazard of danger to anyone passing by”*.

INSERT TABLE 2 NEAR HERE

At other times these front-line workers were dealing with slip hazards on the shop floor. These were created by spillages mainly of paint or other liquids, but sometimes of food and pencils (Table 3). Rain water too creates slip hazards for customers. One front-line worker noted that the rain water *“was mopped up swiftly with paper towels to ensure the safety of our customers”* and a “ ‘caution

*wet floor' yellow sign was put out", and another worker at a different store, "made sure there's no water on the floor and there are signs set up as well".*

INSERT TABLE 3 NEAR HERE

A number of front-line respondents noted that they had asked for assistance from their immediate colleagues to solve a problem. One reported asking for assistance to carry a heavy item to the back door of the shop. Others reminded team members not to leave *"kick stools on the shop floor"*, because they create a trip hazard, and told *"them where to store [the kick stools] in the warehouse"*.

While there were nine slip hazards reported by respondents in the retail sector there were no such reports by those from logistics. Fewer incidents leading to single-loop learning occurred in the logistics context (Table 2). Nevertheless, front-line workers in logistics did observe that equipment (a pump truck) had been incorrectly placed (left in the walkway) and needed to be moved. They also reported engaging with peers to resolve problems and prevent accidents or improve safety. One worker noticed that *"an operator was reloading a Little York disposable cleaning cloth machine, stood in from of the main door between the fulfilment operations and returns. I'm not quite sure how the machine ended up in front of the door but clearly there was an infringement of Health and Safety and she was exposed to some risk as the door would have opened onto her, so I asked her to move into a safe area to re-load the machine"*. Another *"found someone had entered the warehouse without high-vis [high – visibility vest]. I just reminded him and he's gone back to the security"*. But he concluded by asking the question, *"why security allowed him to go into the warehouse without high-vis?"* (This is contrary to company policy).

Another difference between respondents from logistics and retail was that the managers in the logistics company reported fixing faulty equipment. For example, *"scales that had not been PAT (portable appliance testing) tested within the last 12 months" were "taken out of use", and "faulty lights in the gents' toilets, which was leading the toilets obviously to be in complete darkness ... so the toilets were closed until we could replace the light bulbs"*. No managers in the retail context reported incidents that could lead to single-loop learning.

#### *4.2 Double-loop Learning*

Double-loop learning events were much less common than first-order problem solving incidents (Table 4). Overall, only 13 of these events occurred compared to 48 first-order problem solving events (Table 2). With two exceptions these 13 events were all reported either by managers or front-line workers with a responsibility for safety, because they were either nominated Health and Safety Champions or the union representative.

#### INSERT TABLE 4 NEAR HERE

In the logistics context, managers reported an incident where some of the boxes returned from a retail store contained human excrement. They had raised this with the retail customer and UK Mail, the delivery service, and both organizations were *“going to do an audit”*, while the logistics company was going to *“start an internal investigation”*. These managers were also exploring alternative options for disposing of waste from the floor scrubber with the site management agency. Both examples involved interactions with other organizations.

In contrast front-line workers typically reported issues to superiors in the hierarchy anticipating that they would resolve the problems. For example, the Health and Safety Champion in one of the retail stores reported that *“we would like a mirror installed on our services yard because it has been used as a rat-run, people coming up the wrong way and there’s a blind turn where the forklift prongs would be at engine height for any car coming up there. It’s an issue that [the manager] will raise with the landlord, as we can’t actually do anything outside of what we’ve already done in the yard”*.

Similarly the union representative in the warehouse raised *“an issue in regard to drivers being sent out on vehicles that haven’t been risk assessed for the outlets that they’ll be delivering to. This has been brought up in different ways, i.e. with managers, team leaders and operation controllers”*. But, *“the desired outcome hasn’t occurred”*. He also raised a training issue with HR where concern was *“raised by some people in regards to chemical spillages and not having a fuller understanding on how to deal with them”*, despite them having been trained.

#### 4.3 Learning from Violations

Violations of organizational safety rules were more often reported by the nine respondents from the logistics company than the 12 respondents from the retail context. Moreover, with one exception reported by a supervisor, all other violations were reported by front-line staff and never by managers.

In the logistics company the violations typically centred on the interaction between people and equipment. First individuals were wrongfully present in the same space as equipment. The supervisor *“caught a forklift driver talking to a pedestrian in the aisle and she was sitting on the actual truck .... I explained that no-one sits on the trucks whilst they are talking and the other person should be at least six to eight feet away”*. One front-line worker *“saw pickers entering the racking system where the drivers are in operation, instead of waiting until drivers have left the aisle”*, while another at the same warehouse on a different day noted that *“there was an operator stood with a forklift truck in the racking aisles whilst retrieving [an item] from a high location”*.

Second, individuals were operating equipment apparently without regard for co-workers. One front-line worker reported *"a prime case today with a guy being ignorant on his truck and ignoring the signs of having to beep his horn when coming through the doorways, nearly hitting someone"*. A similar incident occurred at a different warehouse where one front-line worker *"witnessed one person enter and exit ... on their reach truck not using their horns to alert people that they're coming through."*

Other types of violations were apparently related to attempts by workers to accelerate the processes. In one warehouse a front-line worker *"found the person who is booking the stock actually when the double-stack pallets arrive, instead of taking pallets down and scanning the labels from the pallet, she jumped on the pallet and doing this actually to get from one to another pallet"*. At the same warehouse on an earlier occasion a front-line worker *"noticed that one of the operatives had to stand on the pallet to retrieve the stock"*. At a different warehouse the union representative observed that safety guards were not being used, *"we have straps for the FLT (fork-lift truck) drivers to use when putting away and replenishing. These aren't being used because it slows down the process"*. He concluded, *"managers are aware of this occurring and are quite happy for it to continue because it meets the customers' requirements"*.

In the retail company, the violations were often situations immediately resolved by the respondent. Some situations involved equipment. For example one worker noticed that *"the ladder had already been opened and left out"*. According to an earlier interview ladders were supposed to be closed and hung up when not in use. The same worker also noticed that the door on one of the stock cages *"wasn't pinned back correctly"*. If they are open doors on cages are supposed to be pinned back to prevent injuries particularly cuts. In both instances this respondent corrected the mistake. Other circumstances involved stock. At a different store a front-line worker noticed that *"a fairly large item, possibly a wardrobe in a flat pack, had been propped up next to the fire door .... It has been stacked in such a way that it is essentially blocking the fire door. It is only one item but under regulations all fire doors must be kept clear at all times"*. This was subsequently moved.

## 5. DISCUSSION

Learning is widely regarded as being purposeful, leading to improvements in efficiency, productivity and innovation (Dodgson, 1993), which indirectly may impact organizational safety by shaping organizational goals and priorities. Learning may also affect organizational safety directly through the attention given to the processes of incident analysis and impact (Drupsteen and Guldenmund,

2014). However, Drupsteen and Guldenmund (2014) also report that the processes of learning from safety incidents has limited empirical foundation and that Argyris and Schön's theory of single and double-loop learning has relevance for safety improvement. Adopting Argyris and Schön's perspective on learning we have investigated empirically the types of learning that may be apparent from different self-reported safety incidents.

Single-loop learning is considered to be more common in organizations than double-loop learning (Argyris and Schön, 1978). While the latter challenges assumptions underpinning policies and practices and encourages more radical change, the former seeks to achieve pre-determined goals, making only minor adjustments to practise based on feedback to achieve them, and to maintain organizational stability. In this study single-loop learning is evidenced in reports by respondents of how they fixed a presenting problem either single handed (e.g. moving misplaced and therefore unsafe stock) or with others using a standardized procedure (e.g. cleaning up a spillage). This was the more common learning event across all staff. In these cases no information was shared with others. Organizational change to effect improvements to safety practices was unlikely and incidents inevitably recurred as evidenced by the respondent who noted the incorrect juxtaposition of a suitcase and microwave, also a few days later reporting another problem with stock; a potential trip hazard.

Single-loop learning from safety incidents has been found to dominate within the high hazard energy sector (Lukic et al., 2012), potentially driven by a focus on increasing efficiency (Carroll et al., 2002).. This was an organizational priority for the retail and logistics companies involved in the current study. Carroll et al. (2002) suggest that a centralized bureaucratic structure where control is exercised by strict adherence to standardized rules and procedures precludes challenge and encourages single-loop learning. Furthermore, Tucker et al. (2002) argue that an emphasis on first-order problem solving (or single-loop learning) limits or even prevents organizational learning. Nevertheless, single-loop learning may be effective and efficient for individuals and groups undertaking routine tasks to achieve their objectives in stable environments. However, it may be detrimental to the individual (Tucker and Edmondson, 2003) and organization in the longer term (Carroll et al, 2002) if small-scale incidents are indicative of a wider organizational malaise that will trigger a larger event if they remain unattended too.

Double-loop learning occurs when individuals have the opportunity to challenge the assumptions upon which organizational policies and practices are based and to feed-forward to influence them (Crossan et al., 1999). Inevitably, this requires communication with others who are often in senior positions within the organization or sometimes with external agencies. Both of these types of events



were evident in the data but not extensively. Carroll et al. (2002) note that it is difficult for many organizations to maintain the necessary openness to allow this internal dialogue, and furthermore it may be wasteful of resources to do so. There is a tendency for organizations to impose controls and so constrain learning. Nevertheless following an incident, individuals may engage purposefully with organizations for example by escalating issues to senior management. Lukic et al. (2013) suggest that active engagement of individuals may be fostered by organizational factors that encourage participation, solicit input and provide feedback. In this study, employees with responsibility for safety communicated with others, including external organizations, offering the possibility for double-loop learning (Tucker and Edmondson (2003). Predictably these individuals were the managers and supervisors, who were accountable for organizational safety and who perhaps had more time for discretionary activity in their roles. Surprisingly, however, a number of front-line workers also reported communicating with senior colleagues or external agencies. One explanation for this was that these front-line workers had a particular interest in health and safety because of their additional roles, which permitted them to raise safety concerns with their superiors or with external organizations, and to more confidently challenge the status quo. Challenge is one of several individual characteristics identified by Edmondson (2004) that contributes to organizational learning.

Recognizing safety violations necessarily indicates that the observer has been taught and has learnt the required procedures that govern safe behaviours and actions. The organization has thus influenced the individual (Crossan et al., 1999). Furthermore, violations of safety rules are deemed to be opportunities for organizational learning (Alper and Karsh, 2009; Desai, 2010) because they reveal potential problems with existing organizational practices. Many of the reported incidents appear to correspond to Lawton's situational violations (Lawton, 1998), where organizational pressures override safety considerations. These instances may also indicate heedlessness (Weick and Roberts, 1993). Individuals failed to pay attention to their immediate surroundings, by driving without sounding their horn to warn others. In this study the violations have been restrictively ascribed to incidents observed by others where individuals were "caught in the act". Nevertheless some of the incidents caused by errors and defined here as single-loop learning opportunities may also indicate earlier violations of standard operating procedures confirming the observation that the distinction between violation and errors may not always be clear (Reason, 1990). For example, in several cases the presenting problem (ascribed here as an error with potential for single-loop learning) was a situation created by the violation of a known standard operating procedure by another person, e.g. the failure to close and replace a stepladder in the retail store or a pump truck left in the walkway of the warehouse. These observations of violations of a policy or a practice by

another person also present the opportunity for single-loop learning, as indicated in Sanne's study (2008) of Swedish railway technicians.

Problems, errors and violations are the focal incidents for learning in this study. Many of these constitute 'near-misses' defined as an event that has the potential to cause harm (Health and Safety Executive, 2004). For example blocking a fire door, leaving a ladder unattended on the shop floor and driving a reach truck through doors without sounding a horn to warn nearby workers all constitute 'near misses'. However, the numbers of near miss incidents formally reported in these organizations at the time of the study were small. None of the retail stores reported a near-miss incident during the period of study, but we identify six incidents from the data that could be described as near-misses. Similarly in the logistics company four respondents at one warehouse observed a total of four incidents yet the records for the whole warehouse employing almost 900 people in the same period revealed only eight accidents and six near-misses. It seems likely therefore that actual numbers of incidents exceed the reported numbers. This finding directly challenges the veracity of near-miss data. If near-miss data form the foundation for guiding safety policies and practices in organizations then greater emphasis needs to be placed upon accurate reporting. Zhao and Olivera (2006) provide three broad categories of reasons why errors may not be reported: emotional reasons; situational ambiguity and lack of awareness. Awareness of near miss reporting systems and their ease of use, especially in target driven environments, like retail and logistics, are considered to be significant factors in the design of accessible error reporting systems (Pfeiffer et al., 2010). The audio recorders used in this study encouraged respondents to remain attentive to safety issues and potentially provide an effective and accessible means of reporting near misses.

As far as we are aware diary methods have not been used in safety research. On the basis of this study, audio diaries have the potential to make a significant contribution to safety research in three areas.. Firstly, they may help to develop our understanding of the actual practices of safe working by revealing how employees respond to circumstances around them. Secondly, drawing on Snook's (2000) theory of practical drift, the use of diaries may help to reveal where 'actual practices' in the work place differ from the 'espoused practices' of the documented safety policy and written procedure. This might also allow a more in-depth study of safety violations complementing the time-intensive, costly ethnographic approach adopted by Sanne (2008), Mascini (2005) and Iszatt-White (2007), Thirdly, diaries such as those in the current study can reveal when safety becomes salient to employees. The high reliability organization literature indicates that mindfulness is critical for safe operations in high hazard settings (Weick and Sutcliffe, 2001). The use of audio recorders which are

convenient to carry, simple to operate, unobtrusive and potentially permitting 'real-time' reflection, allows an examination of mindfulness in a variety of organizational settings.

The study has a number of limitations associated with the method and the analytical framework. Recording the responses of 21 respondents for two weeks to identify learning from safety related incidents is a small sample, dictated by access to and availability of volunteers, and caution should be exercised in extrapolating beyond these contexts. In order to collect sufficient data and to accommodate temporal variation in safety perhaps due to seasonal work pressures, we recommend data collection for a longer period of one month. Other diary studies albeit in different contexts have longer durations. Our time frame was a compromise decision reached after discussion with line managers and participants in the organization. It sought to avoid the task becoming too onerous and the consequent participant response rate diminishing to unacceptably low levels. Therefore we also recommend where possible greater involvement with potential participants before commencing the study so that the benefits of participating are clear to all. This would also ensure that email or text message reminders to complete the diary, which we also recommend would be viewed favourably and actioned. Our respondents did not always remember to make recordings. Some were more diligent than others despite reminders. It is important to test the clarity of the written and oral instructions and participant understanding of what is required prior to commencing the study. Participants in our study provided a variety of responses ranging from a brief observation (of a few words only) to a more lengthy observation and reflection. A fifth and final recommendation would be to use audio diaries rather than written ones because they are portable, convenient to use, accessible and can potentially capture data 'in the moment' rather than waiting to write up the recollection of the event at a later time.

## 6. CONCLUSION

Learning for safety was indicated in this study of retail and logistics organizations in three ways. First, employees adopted a single-loop model of learning in response to safety incidents, which echoes other work and suggest that organizational learning from the more common-place and frequently occurring safety incidents was limited. A propensity for single-loop learning may help to explain why incidents regularly recur. Second, a model of double-loop learning was apparent to a more limited extent and then only by those who were accountable for safety in because of their formal roles. Providing pathways for participation, encouraging input and giving feedback may informally enable a greater number of individuals to engage more effectively in double-loop learning (Lukic, et al. 2013) rather than relying on role specifications to stimulate safety learning in organizations. Third, the observation of violations indicates the influence of prior learning of standard operating procedures

through organizational training. This suggests strongly that while learning has occurred for some it is either not universally embedded or that there has been a drift in day-to-day practice away from that prescribed in the standard operating procedure.

Two other conclusions may also be drawn from this study. The data were drawn from a small number of people over a short period of time, yet they contain a number of near-miss incidents that exceed the numbers officially recorded. The accuracy of near-miss data to guide the development of safety policy and practice may therefore be questionable. Finally, audio diaries may be used to effectively gather data on safety practices in real time within organizations, providing rich qualitative data to support our understanding of safe working.

#### ACKNOWLEDGEMENTS

We thank the Institution of Occupational Safety and Health (IOSH) for funding this research as part of their research programme Health and Safety in a Changing World. The paper does not necessarily reflect the views of IOSH.

#### REFERENCES

- Alper, S. J., Karsh, B. T. 2009. A systematic review of safety violations in industry. *Accident Analysis & Prevention* 41(4): 739-754.
- Argyris, C. 1976. Single-loop and double-loop models in research on decision making. *Administrative Science Quarterly* 21(3): 363-375.
- Argyris, C., Schön, D. 1978. *Organizational learning: A theory of action approach*. Reading, MA: Addison Wesley.
- Argyris, C., Schön, D. A. 1974. *Theory in practice*. Jossey-Bass: San Francisco.
- Atewologun, A. 2011. An examination of senior Black, Asian and Minority Ethnic women and men's identity work following episodes of identity salience at work. Unpublished doctoral dissertation. Cranfield University, UK.
- Barling, J., Loughlin, C., Kelloway, E.K. 2002. Development and test of a model linking safety-specific transformational leadership and occupational safety. *Journal of Applied Psychology* 87(3), 488-496.
- Beck, T. E., Plowman, D. A. 2009. Experiencing rare and unusual events richly: The role of middle managers in animating and guiding organizational interpretation. *Organization Science* 20(5), 909-924.

- Bennett, N. and Lemoine, G.J. 2014. What a difference a word makes: understanding threats to performance in a VUCA world. *Business Horizons* 57(3), 311-317.
- Bentley, T. A., Haslam, R.A. 2001. A comparison of safety practices used by managers of high and low accident rate postal delivery offices. *Safety Science* 37, 19-37.
- Buchanan, D.A., Denyer, D. 2015. What's the problem? In: Denyer, D., Pilbeam, C. (eds) *Managing Change in Extreme Contexts*. pp. 3-23. Routledge: London.
- Carroll, J.S., Rudolph, J.W., Hatakenaka, S. 2002. Learning from experience in high-hazard organizations. *Research in Organizational Behavior* 24, 87-137.
- Crossan, M. M., Lane, H. W., White, R. E. 1999. An organizational learning framework: From intuition to institution. *Academy of Management Review* 24(3), 522-537.
- Daniels, K., Glover, J., Beesley, N., Wimalasiri, V., Cohen, L., Cheyne, A., and Hislop, D. 2013. Utilizing job resources: Qualitative evidence of the roles of job control and social support in problem solving. *Work & Stress* 27(2): 200-221.
- DeJoy, D.M., Schaffer, B.S., Wilson, M.G., Vandenberg, R.J., Butts, M.M. 2004. Creating safer workplaces: assessing the determinants and role of safety climate. *Journal of Safety Research* 35, 81-90.
- Desai, V.M. 2010. Rule violations and organizational search: a review and extension. *International Journal of Management Reviews* 12,184-200.
- Dodgson, M. 1993. Organizational learning: a review of some literature. *Organization Studies* 14(3), 375-394.
- Drupsteen, L., Guldenmund, F. W. 2014. What is learning? A review of the safety literature to define learning from incidents, accidents and disasters. *Journal of Contingencies and Crisis Management* 22(2), 81-96.
- Edmondson, A. C. 2004. Learning from failure in health care: frequent opportunities, pervasive barriers. *Quality and Safety in Health Care*, 13(suppl 2), ii3-ii9.
- Edmondson, A., Moingeon, B. 1998. From organizational learning to the learning organization. *Management Learning* 29(1), 5-20.
- Fiol, C.M., Lyles, M.A. 1985. Organizational Learning. *Academy of Management Review* 10 (4), 803-813.
- Health and Safety Executive. 2004. Investigating accidents and incidents. <http://www.hse.gov.uk/pubns/priced/hsg245.pdf> (accessed 15 April 2015)
- Iszatt-White, M. 2007. Catching them at it: An ethnography of rule violation. *Ethnography* 8(4), 445-465.
- Kapp, E. A. 2012. The influence of supervisor leadership practices and perceived group safety climate on employee safety performance. *Safety Science* 50(4), 1119-1124.

- Katzeff, C., Nyblom, Å., Tunheden, S. and Torstensson, C. (2012). User-centred design and evaluation of EnergyCoach – an interactive energy service for households. *Behaviour & Information Technology* 31(3): 305-324.
- Kelloway, E.K., Mullen, J., Francis, L. 2006. Divergent effects of transformational and passive leadership on employee safety. *Journal of Occupational Health Psychology* 11(1), 76-86.
- King, N. 2006. Using templates in the thematic analysis of text. In: Cassell, C., Symon, G. (eds.) *Essential Guide to Qualitative Methods in Organizational Research* pp. 256-270. Sage Publishers: London.
- Lampel, J., Shamsie, J., Shapira, Z. 2009. Experiencing the improbable: Rare events and organizational learning. *Organization Science* 20(5), 835-845.
- Lawton, R. 1998. Not working to rule: understanding procedural violations at work. *Safety Science* 28(2), 77-95.
- Lukic, D., Margaryan, A., Littlejohn, A. 2013. Individual agency in learning from incidents. *Human Resource Development International* 16(4), 409-425.
- Lukic, D., Littlejohn, A., Margaryan, A. 2012. A framework for learning from incidents in the workplace. *Safety Science* 50(4), 950-957.
- Lukic, D., Margaryan, A., Littlejohn, A. 2010. How organisations learn from safety incidents: a multifaceted problem. *Journal of Workplace Learning* 22(7), 428-450.
- Mascini, P. 2005. The Blameworthiness of Health and Safety Rule Violations. *Law & Policy* 27(3), 472-490.
- Maslen, S. 2014. Learning to prevent disaster: An investigation into methods for building safety knowledge among new engineers to the Australian gas pipeline industry. *Safety Science* 64, 82-89.
- Office for National Statistics 2013. <http://www.ons.gov.uk/ons/rel/census/2011-census-analysis/170-years-of-industry/170-years-of-industrial-changeponent.html> (accessed 15 April 2015)
- Ohly, S., Sonnentag, S., Niessen, C., Zapf, D. 2010. Diary studies in organizational research: An introduction and some practical recommendations. *Journal of Personnel Psychology* 9(2), 79-93.
- Patton, M. 2005. *Qualitative research*, John Wiley & Sons, London.
- Pfeiffer, Y., Manser, T., Wehner, T. 2010. Conceptualizing barriers to incident reporting: a psychological framework. *Quality and Safety in Health Care* 19, e60. DOI: 10.1136/qshc.2008.030445.
- Podsakoff, P.M., MacKenzie, S.B., Jeong-Yeon, L., Podsakoff, N.P. 2003. Common method biases in behavioural research: a critical review of the literature and recommended remedies. *Journal of Applied Psychology* 88 (5), 879-903.

- Poppleton, S., Briner, R. B., Kiefer, T. 2008. The roles of context and everyday experience in understanding work-non-work relationships: A qualitative diary study of white-and blue-collar workers. *Journal of Occupational and Organizational Psychology* 81(3), 481-502.
- Reason, J., Parker, D., Lawton, R. 1998. Organizational controls and safety: the varieties of rule-related behaviour. *Journal of Occupational and Organizational Psychology* 71, 289-304.
- Reason, J.T. 1990. *Human Error*. Cambridge University Press: New York.
- Sanne, J. M. 2008. Incident reporting or storytelling? Competing schemes in a safety critical and hazardous work setting. *Safety Science* 46, 1205-1222.
- Shipton, H. 2006. Cohesion or confusion? Towards a typology for organizational learning research. *International Journal of Management Reviews* 8(4), 233-252.
- Smallman, C. 2001. The reality of "revitalizing health and safety". *Journal of Safety Research* 32(4), 391-439.
- Snook, S. A. 2000. *Friendly fire: the accidental shootdown of US Black Hawkes over Northern Iraq*. Princeton University Press, Princeton.
- Somerville, M., Lloyd, A. 2006. Codified knowledge and embodied learning: the problem of safety training. *Studies in Continuing Education* 28(3), 279-289.
- Størseth, F., Tinmannsvik, R. K. 2012. The critical re-action: Learning from accidents. *Safety Science* 50(10), 1977-1982.
- Symon, G. 2006. Qualitative research diaries. In: Cassell, C., Symon, G. pp. 98-113. *Essential Guide to Qualitative Methods in Organizational Research*. SAGE Publications, London, UK.
- Tucker, A. L., Edmondson, A. C. 2003. Why hospitals don't learn from failures?: organizational and psychological dynamics that inhibit system change. *California Management Review* 45(2), 55-72.
- Tucker, A. L., Edmondson, A. C., Spear, S. 2002. When problem solving prevents organizational learning. *Journal of Organizational Change Management* 15(2), 122-137.
- Vaughan, D. 1999. The dark side of organizations: mistake, misconduct and disaster. *Annual Review of Sociology* 25, 271-305.
- Weick, K. E., Roberts, K. H. 1993. Collective mind in organizations: Heedful interrelating on flight decks. *Administrative Science Quarterly* 38, 357-381.
- Weick, K. E., K. M. Sutcliffe. 2001. *Managing the Unexpected*. Jossey-Bass: San Franscisco, CA.
- Zanko, M., Dawson, P. 2012. Occupational health and safety management in organizations: a review. *International Journal of Management Reviews* 14(3), 328-344.
- Zhao, B., Olivera, F. 2006. Error reporting in organizations. *Academy of Management Review* 31(4), 1012-1030.

Zohar, D., Luria, G. 2003. The use of supervisory practices as leverage to improve safety behavior: A cross-level intervention model. *Journal of Safety Research* 34(5), 567-577.



Table 1. Numbers of participants according to their rank and sector of employment.

| Sector                   | Diarist's Rank within their Organisation |            |            | Total Number of Diarists |
|--------------------------|--|------------|------------|--------------------------|
|                          | Frontline                                | Supervisor | Management |                          |
| Logistics                | 5  | 2          | 2          | 9                        |
| Retail                   | 8  | 3          | 1          | 12                       |
| Total Number of Diarists | 13                                       | 5          | 3          | 21                       |

Table 2. Number of reports of incidence of single-loop learning by different categories of staff in retail and logistics organizations.

|           | Role Category     |            |         | Total |
|-----------|-------------------|------------|---------|-------|
|           | Front-Line worker | Supervisor | Manager |       |
| Retail    | 28                | 8          | 0       | 36    |
| Logistics | 4                 | 2          | 6       | 12    |
| Total     | 32                | 10         | 6       | 48    |

Table 3. Responses to different spilt items in retail settings.

| Spilt Item | Observation   |
|------------|---|
| Paint      | <p>“a couple of colleagues were checking a tin of paint and the lid came off. That was easily cleared up with a few paper towels, unlike the usual thing where we have to get a trolley out and just put some compost down to soak all the paint up”.</p> <p>“we had a big paint spillage today, a lot of paint which would have caused a slip hazard. It has been sorted straight away”.</p> |
| Food       | <p>“Somebody has spilt popcorn on the shop floor. Not the most exciting of things but it had to be swept up and everything, and I had to let the manager know”.</p> <p>“A child has spilt a drink of some sort onto the shop floor, but it was cleaned up immediately and put with a ‘wet floor’ sign”.</p>   |
| Pencils    | <p>“I noticed several pencils on the floor underneath one of the gondolas bearing the catalogues. I am simply going to pick these up and put them away in their correct place”.</p>   |

Table 4. Number of reports of incidence of double-loop learning by different categories of staff in retail and logistics organizations.

|           | Role Category     |            |         | Total |
|-----------|-------------------|------------|---------|-------|
|           | Front-Line worker | Supervisor | Manager |       |
| Retail    | 3                 | 2          | 0       | 5     |
| Logistics | 5                 | 0          | 3       | 8     |
| Total     | 8                 | 2          | 3       | 13    |

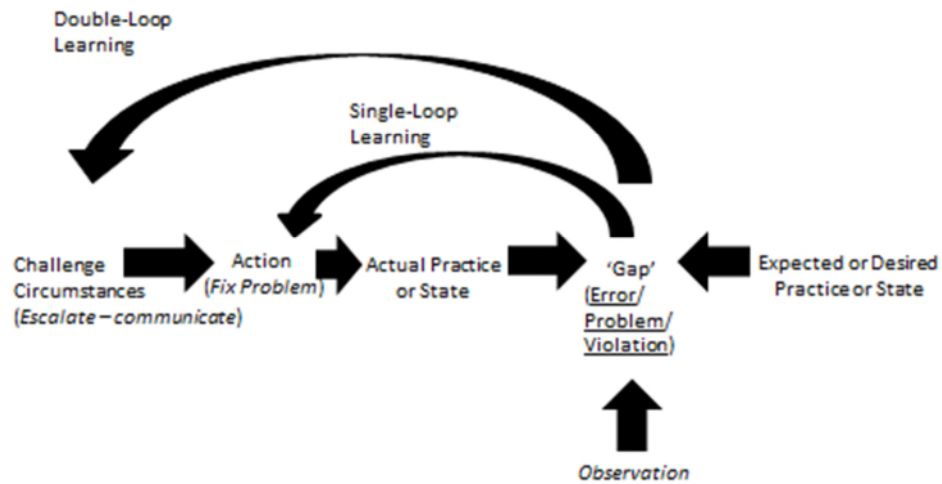


Figure 1. Model of possible safety learning opportunities arising from a 'gap' between an actual or expected state or practice caused by errors, problems and violations (Inspired by Carroll et al., 2002). Items in italics represent actions evident in the data either explicitly (fix problem/ escalate-communicate) or implicitly (observation).

2015-08-28

# What learning happens? Using audio diaries to capture learning in response to safety-related events within retail and logistics organizations

Pilbeam, Colin

Elsevier

---

Pilbeam C, Davidson R, Doherty N, Denyer D. (2016) What learning happens? Using audio diaries to capture learning in response to safety-related events within retail and logistics organizations. *Safety Science*, Volume 81, January 2016, pp. 59-67

<https://doi.org/10.1016/j.ssci.2015.07.034>

*Downloaded from Cranfield Library Services E-Repository*